Paper No. 13

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TSUNG-CHIEH TSAI, CHING-SHAN LU and TOM TSENG

Appeal No. 2004-1123
Application No. 09/933,503

ON BRIEF

Before COHEN, FRANKFORT, and BAHR, Administrative Patent Judges.

FRANKFORT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 10 through 20, all of the claims remaining in this application. Claims 1 through 9 have been canceled.

Appellants' invention relates to a moisture-controlled semiconductor wafer storage container and method that utilizes a moisture-absorbing device in the wafer storage container for controlling relative humidity in the cavity of the container to less than 30%. Independent claims 10 and 16 are representative

of the subject matter on appeal and a copy of those claims may be found in the Appendix to appellants' brief (Paper No. 10).

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Parikh et al. (Parikh)	4,739,882	Apr. 26, 1988
Baseman et al. (Baseman)	5,346,518	Sep. 13, 1994
Roberson, Jr. et al. (Roberson)	5,879,458	Mar. 9, 1999
Brooks	6,155,027	Dec. 5, 2000

Claims 10 through 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Baseman in view of Brooks, Roberson and Parikh.

Rather than reiterate the examiner's full statement of the above-noted obviousness rejection and the conflicting viewpoints advanced by the examiner and appellants regarding that rejection, we make reference to the examiner's answer (Paper No. 11, mailed December 24, 2003) for the examiner's reasoning in support of the rejection, and to appellants' brief (Paper No. 10, filed September 29, 2003) for the arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to appellants' specification and claims, to the applied prior art references, and to the respective positions articulated by appellant and the examiner. As a consequence of our review, we have made the determination which follows.

In considering the examiner's rejection of claims 10 through 20 under § 103(a), we note that the "Background of the Invention" portion of appellants' specification informs us that in the field of semiconductor fabrication it has become desirable to operate in an extremely high cleanliness minienvironment that eliminates micro-contamination and reduces native oxide growth on silicon surfaces. Figure 1 of the application is designated "Prior Art" and schematically shows such a high cleanliness minienvironment (10). Semiconductor wafers to be processed are transported into the high cleanliness minienvironment via a standard mechanical interface apparatus (SMIF) located at a loading and unloading section (14). More particularly, a cassette (30) of wafers is transported into the high cleanliness minienvironment from a SMIF pod (18) situated on top of the SMIF apparatus (20).

Appellants' Background portion of the specification continues by noting (page 5) that the SMIF pod is used not only for transporting wafer cassettes between various processing stations, but also in the storage of wafer cassettes waiting to be processed. In that context, it is indicated that the SMIF pods will generally have contained therein an atmosphere the same as the atmosphere of a processing "clean room," i.e., among other things, having a regulated amount of moisture in the range of between about 30% to about 50% relative humidity. However, as noted on page 6 of the specification, it has also been recognized by those skilled in the art that such a humidity level in the SMIF pod can have an adverse effect on wafers stored in the wafer cassette contained in the SMIF pod, e.g., causing film stress variations and/or corrosion of metal film layers on the wafers. On page 7 of the specification, appellants note that the moisture absorption problem incurred in the conventional SMIF pod has lead IC process engineers to propose various solutions to that problem. Appellants characterize some of those solutions as being difficult to carry out and/or cumbersome to carry out in an IC fabrication facility.

Like the examiner, we view the patents to Baseman, Roberson, Parikh and Brooks applied in the rejection before us on appeal as also addressing contamination problems, similar to those noted by appellants, in SMIF pods and other wafer storage containers. In that regard, Brooks (col. 1) mentions the need for removing contaminants such as "moisture, oxygen, ion contaminants and the like" from a wafer storage container interior and maintaining the interior contaminant free for an extended period of time. Brooks expressly notes that, due to the ever increasing sensitivity of semiconductor wafers, the presence of even infinitesimal amounts of contaminants is a drawback to quality production and the elimination of rejects. In Brooks, column 1, lines 42-49, it is indicated that one known form of protection is to use a desiccant, such as Silica Gel, prepackaged in a vapor transmission type material which is placed within the plastic wafer storage container prior to sealing thereof. The desiccant is said to act to absorb atmospheric contaminants such as moisture vapor and oxygen during packaging and storage of wafers. However, Brooks further notes that desiccants have a relatively limited shelf-life and therefore may eventually require time consuming and expensive repackaging and replacement. Thus, Brooks proposes an alternative purging method and apparatus which

permits periodic removal of contaminants from the wafer package interior during extended storage thereof. Although Brooks emphasizes that even "infinitesimal" amounts of contaminants can adversely effect wafer quality, this patent does not mention any specific level of contaminants, such as moisture, oxygen, ion contaminants, etc., that would be acceptable.

Similar to Brooks, Roberson recognizes that it is desirable in a wafer storage SMIF pod used in processing and storage of semiconductor wafers to achieve a desirable level of relative humidity, oxygen and particulates. Roberson proposes a purging system to achieve desired levels of contaminants within the storage pod and notes that, ideally, the SMIF pod should be completely purged to desired levels of relative humidity, oxygen, etc., specifically indicating that relative humidity levels of about 0.1% or less have been achieved (col. 6, lines 33-37).

Baseman discloses a SMIF pod used to protect semiconductor wafers during manufacture, storage and transport. Similar to the prior art in column 1 of Brooks, Baseman uses a pre-formed vapor removal element disposed within the SMIF pod to absorb vapors inside the closed pod (see, e.g., element (30) in Figs. 6A, 7, 8,

10, 13 and 14). Although Baseman notes that the vapor removal element (30) may typically include an activated carbon absorber, it is further indicated (col. 8, lines 43-44) that "[t]he preferred material for the absorber layer 32 depends on the vapor chemistry." The objective in Baseman, like the other patents noted above, is to achieve a small or otherwise acceptable vapor concentration level within the SMIF pod enclosure, thereby preventing damage to, or degradation of, the semiconductor wafers (note, for example, the paragraph spanning columns 2 and 3 of Baseman, and col. 1, lines 40-53). In column 8, lines 29-33, it is noted that

> [a]ny vapor located near the vapor removal element 30 will rapidly travel a small distance by diffusion, percolation or airflow, through channels 38 in guard plate 36, through a barrier layer 34, into the absorber layer 32 where the vapor is removed from the air.

At column 10, lines 25-32, Baseman discusses "Relative Vapor Concentration" (RVC) and expressly notes that for vapor and wafers without specific chemical interactions, at RVC less than 10%, typically there will be little vapor deposition on a wafer. However, Baseman goes on to note that at about 25% RVC, an approximate mono-molecular layer will form on a wafer. In accord with the desire in Baseman to achieve a very low vapor

concentration, we note that claim 1 of that patent specifically requires a vapor removal element which maintains the relative vapor concentration (RVC) in a SMIF pod enclosure "at ten percent (10%) or less" to thereby inhibit the formation of contaminating layers on the vapor sensitive products (i.e, semiconductor wafers).

As noted by the examiner on page 3 of the answer, Parikh discloses the use of interior liners (202, 204) and (350, 352) in SMIF pods to further reduce particle contamination of wafers stored in such pods. As can be seen best in Figure 10, the liners completely surround the cassette and wafers carried within the SMIF pod and are sealed to the base of the pod so that no contamination is allowed to enter the interior space where the articles (wafers) are contained. As noted in column 8 of Parikh, in one embodiment the liners are "electret material" which has the property of attracting and holding small charged particles, while in another embodiment the liners may include adhesive material on their inner surfaces which tends to hold particles which strike the liners.

Based on the collective teachings of the patents discussed above, the examiner has determined that it would have been obvious to one of ordinary skill in the art at the time appellants' invention was made to arrive at a SMIF pod and method like that claimed by appellants. In particular, the examiner has concluded (answer, page 3) that it would have been obvious to one of ordinary skill in the art at the time of appellants' invention to utilize Silica Gel and interior liners in the semiconductor storage pod of Baseman, given the teachings in Brooks and Roberson that it is desirable in that environment to reduce water vapor in the pod interior and keep relative humidity at "desired levels" as low as 0.1% or less, and the teaching in Parikh of using inner liners in such SMIF pods to seal and further protect the semiconductor wafers therein from contamination.

We concur in the examiner's assessment of obviousness of the claimed subject matter under 35 U.S.C. § 103(a), and again highlight that the Baseman patent itself teaches (col. 10, lines 25-32 and claim 1) that a vapor removal element which maintains the relative vapor concentration (RVC) in a SMIF pod enclosure "at ten percent (10%) or less" is desirable and inhibits the formation of contaminating layers on the vapor sensitive products

(i.e, semiconductor wafers) stored therein. Unlike appellants, we are of the opinion that the examiner has clearly established a proper case of obviousness and has not engaged in hindsight reconstruction based on appellants' disclosure and claims.

While it is true that Baseman does not specifically mention removing moisture (water vapor) from the SMIF pod disclosed therein, we are convinced that one of ordinary skill in the semiconductor fabrication and processing arts would have readily recognized that Baseman's broad reference to "chemical vapors" and "environmental airborne vapors" that are everywhere in the environment in low concentrations (col. 1, lines 40-43) encompass water vapor, especially since appellants' own specification (pages 6-7) indicates recognition in the art of particular problems associated with the presence of moisture in SMIF pods and notes attempts by IC process engineers to solve that problem. In addition, the teachings in both Brooks and Roberson emphasize the need in the semiconductor fabrication and storage art to remove moisture, oxygen and other contaminants from SMIF pods and to control relative humidity to levels of 0.1% or less. In that regard, we also again note the disclosure in Baseman of maintaining the relative vapor concentration (RVC) in a SMIF pod

enclosure "at ten percent (10%) or less" so as to inhibit the formation of contaminating layers on the semiconductor wafers stored therein.

As for appellants' arguments (brief, page 6) regarding Brooks and Roberson, we agree that Brooks does not specifically teach controlling a relative humidity in the wafer storage container therein "to not higher than 30%" as set forth in the claims on appeal, however, we again observe that this patent at column 1, lines 21-27, emphasizes that semiconductor wafers have become so contaminant-sensitive that even "infinitesimal amounts" of contaminants are a drawback to quality production and the elimination of rejects. Closely following that disclosure, Brooks specifically discusses the use of desiccant packages of Silica Gel within semiconductor wafer storage containers to absorb atmospheric contaminants such as moisture and oxygen during packaging and storage. Thus, we consider that this patent at least inferentially would have suggested to one of ordinary skill in the art the reduction of contaminants such as moisture and oxygen to below "infinitesimal amounts" in order to protect the semiconductor wafers transported and stored in the containers therein. Contrary to appellants' assertion, Roberson does teach

controlling a relative humidity in the cavity of a SMIF pod to be less than 30%, i.e., to have a relative humidity level of about 0.1% or less (col. 6, lines 33-37). Although Roberson uses a desiccator (20) located outside the SMIF pod to dry the purge gases prior to their entry into the pod, this patent nonetheless instructs those in the art that levels of contaminants such a water vapor, oxygen and particulates in a SMIF pod should be maintained at desired levels of 0.1% or less.

Regarding appellants' argument (brief, pages 7-8) concerning the liners of Parikh and their use in Baseman, we agree with the examiner that there is ample suggestion in Parikh for using liners like those seen at (e.g., 202, 204 or 350, 352) of Parikh in the SMIF pod of Baseman to substantially seal the interior of the cassette carrying portion of the pod from the surrounding environment outside the pod so as to preclude contamination from entering the interior space where the semiconductor wafers are stored and thus better protect the wafers. Moreover, we see nothing in appellants' specification or claims that in any way precludes the liners described therein from being replaceable if ultimately contaminated, as taught in Parikh. Following the teachings of Baseman and Brooks, it is clear to us that the vapor

removal element of Baseman used to reduce the chemical vapors, e.g., water vapor, that might damage or degrade the semiconductor wafers stored in the SMIF pod would be located in the cavity where the wafer cassette is carried, i.e., inside the liners of the combination SMIF pod as posited by the examiner and, following the teachings of Baseman and Roberson, such vapor removal element would provide an environment inside the SMIF pod/liners having a "Relative Vapor Concentration (RVC) or relative humidity of less that 10%, and possibly as low as 0.1%.

In reaching our above conclusion, we note that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference, nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art at the time of appellants' invention. See, In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). Moreover, we emphasize that we have presumed skill on the part of the artisan, rather than the converse. See In re Sovish, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir 1985).

In light of the foregoing, the examiner's rejection of claims 10 through 20 under 35 U.S.C. § 103(a) is sustained, and the decision of the examiner rejecting claims 10 through 20 is therefore affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

IRWIN CHARLES COHEN Administrative Patent Judge	)
CHARLES E. FRANKFORT Administrative Patent Judge	) BOARD OF PATENT APPEALS AND INTERFERENCES
JENNIFER D. BAHR Administrative Patent Judge	)

CEF/lbg

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